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Research Abstracts

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CURRENT NACA REPORTS

NACA TN 2323

THEORETICAL INVESTIGATION OF SUBMERGED INLETS AT LOW SPEEDS. Alvin H. Sacks and John R. Spreiter. August 1951. 48p. diagrs., photos. (NACA TN 2323)

The flow field in a submerged inlet is investigated by theoretical, wind-tunnel, and visual-flow studies. Equations are developed for the growth of the ramp-floor boundary layer for parallel, divergent, and convergent ramp walls; and a general equation is derived relating the boundary-layer pressure losses to the boundary-layer thickness. The formation of a vortex pair in the divergent-ramp inlet is discussed, and relationships are established between the vortex pressure losses and the geometry of the inlet.

NACA TN 2391

FURTHER COMPARISONS OF THEORETICAL AND EXPERIMENTAL LIFT AND PRESSURE DISTRIBUTIONS ON AIRFOILS IN CASCADE AT LOW-SUBSONIC SPEED. S. Katzoff and Margery E. Hannah. August 1951. 24p. diagrs. (NACA TN 2391)

Comparisons of theoretical and experimental lift coefficients and pressure distributions were made for five compressor-type cascades of highly cambered NACA 6-series airfoils. The experimental lift coefficients were 0.2 to 0.4 less than the theoretical for the same mean-flow direction. When the theoretical lift was made equal to the experimental lift by simply adjusting the circulation to the desired value, the Kutta condition being neglected, close agreements were obtained between the pressure distributions. The data (low-speed) were obtained by the newer technique of NACA TN 2028, and the comparisons are substantially better than those previously reported in NACA TN 1376.

NACA TN 2425

PLASTIC STRESS-STRAIN RELATIONS FOR 75S-T6 ALUMINUM ALLOY SUBJECTED TO BIAXIAL TENSILE STRESSES. Joseph Marin, B. H. Ulrich and W. P. Hughes, Pennsylvania State College. August 1951. 48p. diagrs., photos., 5 tabs. (NACA TN 2425)

Constant-stress-ratio tests, variable-stress-ratio tests, and special tests were made on a tubular 75S-T6 aluminum-alloy specimen. The stresses used were essentially biaxial and tensile stresses. The constant-stress-ratio test results gave control data and showed the influence of biaxial stresses on the yield, fracture, and ultimate strength of the material. It is possible to determine from certain variable-stress-ratio tests whether there is any significant difference between the flow and deformation type of theory. The special tests checked specific assumptions made in the theories of plastic flow.

NACA TN 2426

AN INVESTIGATION OF AIRCRAFT HEATERS. XXXIV - EXPERIMENTAL DETERMINATION OF THERMAL AND HYDRODYNAMICAL BEHAVIOR OF AIR FLOWING BETWEEN A FLAT AND A WAVE-SHAPED PLATE. L. M. K. Boelter, V. D. Sanders, G. Young, M. Morgan and E. H. Morrin, University of California. August 1951. 30p. diagrs. (NACA TN 2426)

Investigation was conducted on thermal and hydrodynamical behavior of air flowing along a passage of which one side was flat and steam-heated and the other side was wave-shaped and unheated. Turbulence produced by air flowing over wavy surfaces approximately doubles heat-transfer rate for narrow duct widths. At large duct widths, the effect is negligible. Pressure drop was greatly increased over that for a straight duct. Pressure drop was increased to at least 4 times for large duct widths and to at least 10 times for small duct widths.

NACA TN 2428

AN INVESTIGATION OF AIRCRAFT HEATERS. XXXVI - PRELIMINARY INVESTIGATION OF A COMBUSTION-TYPE AIRCRAFT HEATER. L. M. K. Boelter, W. R. Elswick, V. D. Sanders and M. W. Rubesin, University of California. August 1951. 15p. diagrs. (NACA TN 2428)

Experimental results on the thermal performance of an aircraft combustion-type heater are presented. Evaluation of the thermal effectiveness of the heater reveals that the effects of gaseous radiation and turbulence due to combustion are negligible.

NACA TN 2433

A CRITICAL REVIEW OF NOTCH SENSITIVITY IN STRESS-RUPTURE TESTS. W. F. Brown, Jr. and George Sachs. August 1951. 29p. diagrs. (NACA TN 2433)

A critical review of the English and German literature on notch rupture testing was made to establish the influence of notching on various heat-treated steels and several nonferrous alloys when subjected

to long-time loading at elevated temperatures. A correlation between rupture ductility and notch sensitivity is established for low-alloy steels. Notch rupture data are compared with data obtained at room temperature to reveal the general effects of notch geometry. Notch embrittlement observed for low-alloy steels in rupture tests is discussed with regard to a precipitation reaction and is correlated with the composition and heat treatment.

NACA TN 2434

A BIHARMONIC RELAXATION METHOD FOR CALCULATING THERMAL STRESS IN COOLED IRREGULAR CYLINDERS. Arthur G. Holms. August 1951. 49p. diagrs., 4 tabs. (NACA TN 2434)

A numerical method was developed for calculating thermal stresses in irregular cylinders cooled by one or more internal passages. The use of relaxation methods and elementary methods of finite differences was found to give approximations to the correct values when compared with previously known solutions for concentric circular cylinders possessing symmetrical and asymmetrical temperature distributions.

NACA TN 2437

SOME MEASUREMENTS OF THE EFFECT OF GASEOUS IMPERFECTIONS ON THE CRITICAL PRESSURE RATIO IN AIR AND THE SPEED OF SOUND IN NITROGEN. Coleman duP. Donaldson and Jim J. Jones. August 1951. 15p. diagrs., photos., tab. (NACA TN 2437)

Experiments were made to measure the speed of sound in nitrogen at room temperatures in the pressure range of 0 to 2000 pounds per square inch absolute and the critical pressure ratio of air expanded isentropically from stagnation conditions in the same range. The experimental results were then compared with the values obtained by using the Van der Waals equation and the Beattie-Bridgeman equation.

NACA TN 2440

WIND-TUNNEL INVESTIGATION AND ANALYSIS OF THE EFFECTS OF END PLATES ON THE AERODYNAMIC CHARACTERISTICS OF AN UNSWEPT WING. Donald R. Riley. August 1951. 55p. diagrs., photo., 2 tabs. (NACA TN 2440)

Wind-tunnel results on end-plate effects on the aerodynamic characteristics of an unswept and untapered wing of aspect ratio 4 are presented, and experimental values of the end-plate effects on the lift-curve slope and induced drag are determined and compared with theory. Expressions are developed for the lift-drag and maximum lift-drag ratios and results compared with calculated values. A theoretical analysis is presented to indicate the effect of factors influencing the lift-drag and maximum lift-drag characteristics.

NACA TN 2441

OPTICAL METHODS INVOLVING LIGHT SCATTERING FOR MEASURING SIZE AND CONCENTRATION OF CONDENSATION PARTICLES IN SUPERCOOLED HYPERSONIC FLOW. Enoch J. Durbin. August 1951. 28p. diagrs., photos., 2 tabs. (NACA TN 2441)

Optical methods involving light scattering for measuring the size and concentration of condensation particles in supercooled hypersonic air flow are discussed. For verification of these methods, radii of ammonium-chloride particles were determined, and a comparison of these results with other measurements gave good agreement. By using these methods the size and concentration of condensation particles in supercooled hypersonic air flow were measured. A table of angular-light-intensity-distribution functions is given for use in measuring small particles having an index of refraction of 1.20, the index of refraction of oxygen and nitrogen.

NACA TN 2442

A PHOTOELASTIC INVESTIGATION OF STRESS CONCENTRATIONS DUE TO SMALL FILLETS AND GROOVES IN TENSION. M. M. Frocht, Illinois Institute of Technology. August 1951. 45p. diagrs., photos., 5 tabs. (NACA TN 2442)

Factors of stress concentration for deep, sharp, and symmetrically arranged grooves and fillets in tension members have been determined photoelastically and are given in this report. Curves are given showing the distribution of the principal stresses on the section through the grooves. Complete isopachic patterns for several basic cases of grooved bars are included.

NACA TN 2443

THE SIMILARITY LAW FOR HYPERSONIC FLOW ABOUT SLENDER THREE-DIMENSIONAL SHAPES. Frank M. Hamaker, Stanford E. Neice and A. J. Eggers, Jr. August 1951. 22p. diagrs. (NACA TN 2443)

The similarity law for steady hypersonic flow about slender three-dimensional shapes is derived in terms of customary aerodynamic parameters. The law is employed to determine simple relations for correlating the pressures, forces and moments acting on related shapes in hypersonic flows. In the special case of inclined bodies of revolution, these expressions for the forces and moments are generalized to include some significant effects of the viscous cross force.

NACA RM 51E04

INVESTIGATION OF TORSION CREEP-TO-RUPTURE PROPERTIES OF N-155 ALLOY. C. W. MacGregor and F. J. Walcott, Jr., Massachusetts Institute of Technology. August 1951. 26p. diagrs., photos., 4 tabs. (NACA RM 51E04)

An investigation of the tension creep-to-rupture properties of the alloy steel N-155 was undertaken. Rupture times in the 10-to-1000-hour range were considered and tests were made at the temperatures 1200°, 1350°, and 1500° F. The effect of stress concentration in the form of transverse circular

holes was investigated under the same conditions. Comparisons of the effects of simple combined stresses (as in torsion) were made with torsion creep-to-rupture properties.

NACA RM E51E15

COMBUSTION OF SMOKE IN DIFFUSION AND BUNSEN FLAMES. Thomas P. Clark. August 1951. 13p. diagrs., photos. (NACA RM E51E15)

Varying amounts of smoke, both in the form of concentrated filaments and dilute homogeneous mixtures with the combustible, were burned in diffusion flames of ethylene and in bunsen flames of ethylene-air mixtures. Stable flames of both types were found capable of burning large amounts of carbon smoke if the smoke was finely divided. It was found that finely divided smoke passing through the flame zone in the form of a laminar filament could be completely burned at a relative smoke-fuel carbon ratio within the filament as high as 3.5:1. Conversely, low over-all concentrations of smoke could pass through the reaction zone without burning completely, if the smoke was agglomerated into flecks of soot. The smoke was found to burn in both the inner and the outer cones of the bunsen flame.

NACA TM 1301

THE FLOW OF GASES IN NARROW CHANNELS. (Über die Strömung von Gasen in engen Kanälen). R. E. H. Rasmussen. August 1951. 46p. diagrs., photo., 2 tabs. (NACA TM 1301. Trans. from Annalen der Physik, v.29, ser.5, no.8, August 1937, p.665-697).

Measurements were made of the flow of gases through various narrow channels a few microns wide at average pressures from 0.00003 to 40 cm. Hg. The flow rate, defined as the product of pressure and volume rate of flow at unit pressure difference, first decreased linearly with decrease in mean pressure in the channel, in agreement with laminar-flow theory, reached a minimum when the mean path length was approximately equal to the channel width, and then increased to a constant value. The product of flow rate and square root of molecular number was approximately the same function of mean path length for all gases for a given channel.

NACA TM 1306

THREE PAPERS FROM CONFERENCE ON "WING AND TAIL-SURFACE OSCILLATIONS" - MARCH 6-8, 1941, MUNICH. I. REMARKS CONCERNING AERODYNAMICALLY BALANCED CONTROL SURFACES. (Bemerkung zum aerodynamisch innenausgeglichenen Ruder). H. Söhngen. II. AERODYNAMICALLY EQUIVALENT SYSTEMS FOR VARIOUS FORMS OF CONTROL SURFACES WITHIN THE SCOPE OF THE TWO-DIMENSIONAL WING THEORY. (Aerodynamische Ersatzsysteme für verschiedene Ruderformen im Rahmen der zweidimensionalen Tragflächentheorie). L. Schwarz. III. COMPARATIVE CALCULATIONS CONCERNING AERODYNAMIC BALANCE OF CONTROL SURFACES. (Vergleichsrechnungen zum aerodynamischen Ruderinnenausgleich). F. Dietze. August 1951. 47p. diagrs., tab. (NACA TM 1306. Trans. from Lilienthal Gesellschaft für Luftfahrtforschung, Berlin. Bericht 135, p.61-74).

NACA TM 1307

LATERAL CONTROL BY SPOILERS AT THE DVL. (DVL - Unterbrecherquersteuerung). M. Kramer, Th. Zobel and C. G. Esche. I. SYSTEMATIC WIND-TUNNEL TESTS CONCERNING THE PROBLEM OF LATERAL CONTROL BY SPOILERS PERMEABLE TO AIR. M. Kramer and Th. Zobel. II. CONTRIBUTION TO THE LATERAL CONTROL BY SPOILERS AT THE DVL. M. Kramer. III. FLIGHT TESTS IN THE LATERAL CONTROLS BY SPOILERS ON THE AIRPLANE MODEL FIESELER FI 156. C. G. Esche. August 1951. 82p. diagrs., photo., tab. (NACA TM 1307. Trans. from Zentrale für wissenschaftliches Berichtswesen der Luftfahrtforschung, Berlin. FB 964).

The present report describes the development of spoiler control at the DVL during the period from the end of 1936 until the beginning of 1939.

DECLASSIFIED NACA REPORTS

NACA RM E7C03

DETERMINATION OF RAM-JET COMBUSTION-CHAMBER TEMPERATURES BY MEANS OF TOTAL-PRESSURE SURVEYS. I. Irving Pinkel. March 3, 1947. 10p. diagrs., tab. (NACA RM E7C03) (Declassified from Restricted, 7/3/51)

Describes a method for determining the total temperature of the gases at the combustion-chamber outlet of a ram-jet engine from the loss in total pressure measured across the combustion chamber. Presents a working chart for determining the ratio of the total temperature of the gases at the combustion-chamber outlet to the total temperature of the gases at the combustion-chamber inlet. Values of total temperature ratio across the combustion chamber of a 20-inch ram jet were obtained at pressure altitudes from 6000 to 15,000 feet. The difference between the temperature ratio across the combustion chamber determined from the chart and that obtained from thermocouple measurement was within 6.2 percent of the thermocouple-temperature ratio and within the accuracy of thermocouple measurements.

NACA RM E7C05

INCREASE IN STABLE-AIR-FLOW OPERATING RANGE OF A MIXED-FLOW COMPRESSOR BY MEANS OF A SURGE INHIBITOR. Eugene B. Laskin and Milton G. Kofskey. April 3, 1947. 21p. diagrs., photos. (NACA RM E7C05) (Declassified from Restricted, 7/3/51)

Presents a description and design principles of a surge inhibitor for increasing the stable-air-flow operating range of a mixed-flow compressor operating at high impeller tip speeds. Test results of the compressor unit with the surge inhibitor showed a considerable gain in stable-air-flow operating range over the range of equivalent impeller tip speeds from 1255 to 1738 fps. The surge inhibitor was capable

of increasing the net stable-air-flow operating range more than 8 times its original value at an equivalent tip speed of 1550 fps. The efficiency and the pressure ratio in the normal stable-air-flow operating range were not impaired when the surge inhibitor was inoperative.

NACA RM E9E02

CRITERIONS FOR CONDENSATION-FREE FLOW IN SUPERSONIC TUNNELS. Warren C. Burgess, Jr. and Ferris L. Seashore. June 16, 1949. 41p. diagrs., photos., tab. (NACA RM E9E02) (Declassified from Confidential, 7/3/51)

The results of an investigation of water vapor condensation shocks in the air passing through supersonic tunnels are presented. Criterions for condensation free flow are established by correlating experimental observations with the Volmer theory of nuclei formation. Experimental observations were made at Mach numbers up to 2.00. The criterions are presented in a form independent of tunnel-inlet stagnation pressure and are extended theoretically to a Mach number of 4.0. Preliminary evidence of the effect of tunnel size on the criterions is presented.

NACA RM L6K22

TWO-DIMENSIONAL WIND-TUNNEL INVESTIGATION AT HIGH REYNOLDS NUMBERS OF TWO SYMMETRICAL CIRCULAR-ARC AIRFOIL SECTIONS WITH HIGH-LIFT DEVICES. William J. Underwood and Robert J. Nuber. March 12, 1947. 35p. diagrs., photos., 2 tabs. (NACA RM L6K22) (Declassified from Restricted, 7/3/51)

The investigation was made of airfoils of 6-percent and 10-percent thickness equipped with 0.20-chord plain trailing-edge flaps, 0.15-chord drooped-nose flaps, and 0.10-chord leading-edge extensible flaps. The tests were run at high Reynolds numbers and low Mach numbers ($M \leq 0.14$). Maximum section lift coefficients of 1.95 and 2.03 were obtained at a Reynolds number of 6×10^6 for the optimum combination of drooped-nose and plain flaps for the 6- and 10-percent-thick airfoils, respectively.

NACA RM L8K26

CALCULATION OF AERODYNAMIC FORCES ON A PROPELLER IN PITCH OR YAW. John L. Crigler and Jean Gilman, Jr. February 15, 1949. 32p. diagrs. (NACA RM L8K26) (Declassified from Restricted, 7/3/50)

An analysis was made to determine the applicability of existing propeller theory and the theory of oscillating airfoils to the problem of determining the magnitude of the forces on propellers in pitch or yaw. Strip calculations using compressible airfoil characteristics were first made as though steady-state conditions existed successively at several blade positions of the propeller blades during one revolution. A theory of oscillating airfoils in pulsating incompressible potential flow was then considered from which it was possible to determine factors which would modify the steady-state forces.

BRITISH REPORTS

N-9011*

Aeroplane and Armament Experimental Establishment (Gt. Brit.) STURGEON T.T. MK.2 VR.363 (2 MERLIN 140 S/1). CLIMB AND LEVEL SPEED PERFORMANCE, FUEL CONSUMPTION AND SPECIFIC AIR RANGE (WITHOUT TARGET). May 31, 1951. 26p. diagrs., 10 tabs. (AAEE Rept. A.A.E.E./845/1, pt.9)

With take-off weight of 22,100 lb and intermediate power, the maximum rate of climb was 2,030 ft/min up to full throttle height (9,800 ft), the Service ceiling was 34,800 ft, and the time to Service ceiling was 34.5 min. With weight 21,000 lb, maximum continuous power, and at the full throttle height (23,200 ft), the cruising speed was 282 knots T.A.S. With weight 20,480 lb and at cruising speed of 130 knots I.A.S., the following values were obtained for specific air range: (1) 5,000 ft, M.S. gear - 2.50 N.M.P.G.; (2) 15,000 ft, M.S. gear - 2.78 N.M.P.G.; (3) 25,000 ft, M.S. gear - 2.60 N.M.P.G.

N-9047*

Royal Aircraft Establishment (Gt. Brit.) THE G10/240E DECADE COUNTING VALVE. G. C. Rowley. April 1951. 15p. diagrs. (RAE Tech. Note MS 6)

This note describes the gas-filled decade valve recently developed by Standard Telephones and Cables Ltd., and gives details of suitable circuits. The choice of components for stepping speeds up to 30,000 pps is discussed.

N-9051*

Aeroplane and Armament Experimental Establishment (Gt. Brit.) FIREFLY MK.5 VT.428 (GRIFFON 74). CHECK HANDLING TRIALS WITH AIR/SEA RESCUE CONTAINERS FITTED. May 25, 1951. 3p. (AAEE Rept. A.A.E.E./780,e, pt.11)

When carrying one type "G" air/sea rescue container under each wing, the handling characteristics were indistinguishable from those when carrying other underwing stores. It is considered safe, as far as handling characteristics are concerned, to clear the carriage of these units up to a maximum I.A.S. of 300 knots (the highest tested) It is considered that the carriage of the air/sea rescue container under one wing and either a 45 or 90 gallon drop tank under the other, may be cleared without further tests.

N-9129*

Royal Aircraft Establishment (Gt. Brit.) AN INSTRUMENT FOR INVESTIGATING BOUNDARY LUBRICATING PROPERTIES. E. D. Tingle. March 1951. 21p. diagrs., photo. (RAE Tech. Note Chem. 1148)

A rapid method of comparing the boundary lubricating properties of materials and the durability of

solid lubricant films is described. A modified Wells instrument provides a record of the friction between lubricated metal surfaces at a range of sliding speeds from 0.26 to 5.1 c/s. A standard preparation technique for comparative tests is described.

UNPUBLISHED PAPERS

N-8908*

CRITICAL REVIEW OF VARIOUS REPORTS ON THE INSTABILITY OF FLAT SANDWICH PLATES. (Literatuurstudie over sandwichconstructies IV). F. J. Plantema. 16p., 4 tabs. (Trans. from Nationaal Luchtvaartlaboratorium, Amsterdam. S.364, December 1949)

Presents a review of reports on the buckling of flat sandwich plates. Various treatments on cylinders are not included, while the bending of flat plates is noted only incidentally. Considerations about the efficiency (optimum design) are also excluded.

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